

TABLE 4-2

List of Evaluation Criteria Used to Evaluate the Nature and Extent of Contamination
Gowanus Canal Remedial Investigation
Brooklyn, New York

Surface Sediment, Subsurface Sediment, CSO Sediment

The standards / criteria below are used to evaluate the degree of contamination found in the surface sediments in the Gowanus Canal. These standards / criteria are also used to provide a perspective on the concentrations in subsurface sediments and sediments. The results for the surface sediment reference locations are also compared to the results for the surface sediment locations within the canal.

A. U.S. Environmental Protection Agency (USEPA). 2010. Residential soil RSL from EPA Regional Screening Table, May 2010. RSLs based on noncancer risk divided by 10 to account for exposure to more than one constituent that effects the same target organ.

http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

The standards / criteria listed below are used in the following order to create criteria R: 1) use criteria B1 first; 2) if no criteria available for a constituent under B1, go to C; 3) if no criteria available for a constituent under B1 and C, go to D; and 4) if no criteria available for a constituent under B1, C, and D, go to E and use in this order – E1, E2, E3.

B. New York State Department of Environmental Conservation (NYSDEC). 1999. Technical Guidance for Screening Contaminated Sediments. New York State Department of Environmental Conservation. (Benthic aquatic life chronic toxicity values for saltwater (designated SW)

B1 - NYSDEC 1999 Benthic Aquatic Life Chronic Toxicity (2% TOC)

B2 - NYSDEC 1999 Benthic Aquatic Life Chronic Toxicity (6.5% TOC) – included for informational purposes only

C. Jones, D.S., G.W. Suter II, and R.N. Hull. 1997. Toxicological benchmarks for screening contaminants of potential concern for effects on sediment-associated biota: 1997 revision. Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-95/R4. (Marine and estuarine benchmarks, lower of ERL or TEL values)

D. Washington Department of Ecology (WDOE). 1995. Chapter 173-204 WAC, Sediment Management Standards. <http://www.ecy.wa.gov/biblio/wac173204.html> (Marine Sediment Quality Standards; presented in Table 1, under WAC 173-204-320)

E. Buchman, M.F., 2008. NOAA Screening Quick Reference Tables, NOAA OR&R Report 08-1, Seattle WA, Office of Response and Restoration Division, National Oceanic and Atmospheric Administration, 34 pages. (Marine surface water, chronic values)

E1 - SQUIRTs 2008 Mar SD TEL

E2 - SQUIRTs 2008 Mar SD ERL

E3 - SQUIRTs 2008 Mar SD PEL

Surface Water, CSO Water, Pipe Outfall Water

The standards / criteria below are used to evaluate the degree of contamination found in the surface water in the Gowanus Canal. These standards / criteria are also used to provide a perspective on the concentrations in CSO water, and pipe outfall discharges. The results for the surface water reference locations are also compared to the results for the surface water locations within the canal.

The standards / criteria listed below are used in the following order to create criteria T and S:

Criteria T: Use the lesser of F or G2; use H if no F or G2 criteria available for a constituent.

Criteria S: 1) use criteria L1 first; 2) if no criteria available for a constituent under L1, go to I; and 3) if no criteria available for a constituent under L1 and I, go to K.

F. U.S. Environmental Protection Agency (USEPA). 2009. National Recommended Water Quality Criteria. Office of Water, Office of Science and Technology. Human Health for Consumption of Organism only.

G. New York State DEC, Chapter X, Division of Water, Part 703: Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations. Values correspond to classification of canal (SD) and classification of Bay (I) and are the standards for Health-fish consumption and recreation.

G1 - NYSDEC Chapter X for surface water (fish consumption) I H(FC) – included for informational purposes only, applies to Gowanus Bay

G2 - NYSDEC Chapter X for SW (fish consumption) SD H(FC)

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H. U.S. Environmental Protection Agency (USEPA). 2010. Tap Water RSL from EPA Regional Screening Table, May 2010.

RSLs based on noncancer divided by 10 to account for exposure to more than one constituent that effects the same target organ.

I. U.S. Environmental Protection Agency (USEPA). 2009. National Recommended Water Quality Criteria. Office of Water, Office of Science and Technology. 4303T. Saltwater chronic value (CCC) for the protection of aquatic life.

J. New York State Department of Environmental Conservation (NYSDEC). 1998. Water Quality Standards and Analytical Support. <http://www.dec.ny.gov/chemical/23842.html>. Chronic marine values for protection of aquatic life. (Note that these values have been incorporated into reference L and this reference is included here only to indicate that it was also reviewed).

K. Buchman, M.F., 2008. NOAA Screening Quick Reference Tables, NOAA OR&R Report 08-1, Seattle WA, Office of Response and Restoration Division, National Oceanic and Atmospheric Administration, 34 pages. Marine surface water, chronic values.

L. New York State DEC, Chapter X, Division of Water, Part 703: Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations. Values correspond to classification of canal (SD) and classification of Bay (I) and are the standards for Aquatic-Chronic toxicity.

L1 - NYSDEC Chapter X for surface water (aquatic chronic toxicity) I A(C) – included for informational purposes only, applies to Gowanus Bay

Groundwater

Groundwater was evaluated to assess groundwater interactions with the surface water in the canal. For completeness and to provide a perspective on the significance of detected concentrations at the locations where the monitoring wells were installed, the detected concentrations in groundwater are compared to the standards / criteria listed below.

The standards / criteria listed below are used in the following order to create criteria 1) use criteria N1 first; 2) if no criteria available for a constituent under N1, go to O1; and 3) if no criteria available for a constituent under N1 and O1, go to O2.

N. U.S. Environmental Protection Agency (USEPA). Maximum Contaminant Levels and MCLGs. <http://www.epa.gov/safewater/contaminants/index.html> (N1 is MCLs, N2 is MCLGs).

O. New York State DEC, Chapter X, Division of Water, Part 703: Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations. Values correspond to classification of groundwater along the canal (GA) and are the standards for Health-Water Source and Aesthetic -Water Source (includes O1 and O2).

Air

P. U.S. Environmental Protection Agency (USEPA). 2010. Residential air RSLs from EPA Regional Screening Table, May 2010. RSLs based on noncancer risk divided by 10 to account for exposure to more than one constituent that effects the same target organ.

http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

Soil

Soils were evaluated at the locations where monitoring wells were installed. For completeness and to provide a perspective on the significance of detected concentrations at the locations where the monitoring wells were installed, detected concentrations in soils are compared to the standards / criteria listed below.

Q. New York State DEC. 2009. Subpart 375-6: Remedial Program Soil Cleanup Objectives. December 14, 2006 and NYSDEC Draft CP/Soil Cleanup Guidance, November 4, 2009. Values used correspond to restricted use soil cleanup objectives; Protection of Groundwater.

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Fish Tissue

M. U.S. Environmental Protection Agency (USEPA). 2010. Regional Screening Table, May 2010.

Calculator on the RSL table website based on default assumptions included in calculator tool - not site-specific inputs.

[http://www.epa.gov/reg3hwmd/risk/human/rb-concentration table/Generic Tables/index.htm](http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm)).

http://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search.

AA, AB, AC, and AD:

Fish tissue is compared to both AC (no observed effect concentration) and AD (low observed effect concentration). Blue crab is compared to both AA (no observed effect concentration) and AB (low observed effect concentration).

Cleveland, L., D.R. Buckler, W.G. Brumbaugh. 1991. Residue dynamics and effects of aluminum on growth and mortality in brook trout. *Environ Toxicol Chem* 10:243-248. (AC and AD)

Dillon, T.M. 1984. Biological consequences of bioaccumulation in aquatic animals: An assessment of the current literature. Technical Report D-84-8. U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS. (AC and AD)

Eertmana, R.H.M., C.L.F.M.G. Groeninka, B. Sandeea, H. Hummela and A.C. Smaalb. 1995. Response of the blue mussel *Mytilus edulis* L. following exposure to PAHs or contaminated sediment. *Marine Environmental Research* (AA and AB)

Fabacher, D.L. 1976. Toxicity of endrin and an endrin-methyl parathion formulation to Largemouth bass fingerlings. *Bulletin of Environmental Contamination and Toxicology*. 16(3):376-378. (AC and AD)

Guadagnolo C.M., C.J. Brauner and C.M. Wood. 2001. Chronic effects of silver exposure on ion levels, survival, and silver distribution within developing rainbow trout (*Oncorhynchus mykiss*) embryos (AC and AD)

Hansen, D.J., P.R. Parrish and J. Forester. 1974. Effects of Aroclor(R) 1016 on Embryos, Fry, Juveniles, and Adults of Sheepshead Minnows (*Cyprinodon variegatus*). *Transactions of the American Fisheries Society* 104 (3): 584-588. (AA and AB)

Hansen, J.A., J. Lipton, P.G. Welsh, D. Cacela, and B. MacConnell. 2004. Reduced growth of rainbow trout fed a live invertebrate diet pre-exposed to metal contaminated sediments. *Environmental Toxicology and Chemistry* 23:1902-1911. (AC and AD)

Hook, S.E.; Fisher, N.S. 2001. Sublethal effects of silver in zooplankton: Importance of exposure pathways and implications for toxicity testing. *Environ. Toxicol. Chem.* 20 (3), 568-574. (AA and AB)

Hook, S.E. and N.S. Fisher. 2002. Relating the reproductive toxicity of five ingested metals in calanoid copepods with sulfur affinity. *Mar. Environ. Res.* 53: 161-174. (AA and AB)

Lee, J.H., J.R. Sylvester, C.E. Nash. 1975. Effects of mirex and methoxychlor on juvenile and adult striped mullet, *Mugil cephalus* L. *Bull Environ Contam Toxicol* 14(2):180-185. (AC and AD)

Matta, M.B., J. Linse, C. Cairncross, L. Francendese, R.M. Kocan. 2001. Reproductive and transgenerational effects of methyl mercury or Aroclor 1268 on *Fundulus heteroclitus*. *Environ Toxicol Chem* 20:327-335 (AC and AD)

McGeachy, S.M., and D.G. Dixon. 1990. Effect of temperature on the chronic toxicity of arsenate to rainbow trout (*Onchorhynchus mykiss*). *Can J Fish Aquat Sci* 47:2228-2234. (AC and AD)

Murai, T., J.W. Andrews and R.G. Smith. 1981. Effects of dietary copper on channel catfish. *Aquaculture* 22, 353-357. (AC and AD)

Nakayama, K., Y. Oshima, K. Nagafuchi, T. Hano, Y. Shimasaki and T. Honjo. 2005. Early-life-stage toxicity in offspring from exposed parent medaka, *Oryzias latipes*, to mixtures of tributyltin and polychlorinated biphenyls. *Environmental Toxicology and Chemistry*. 24 (3): 591-596 (AC and AD)

Pierson, K.B. 1981. Effects of chronic zinc exposure on the growth, sexual maturity, reproduction and bioaccumulation of the guppy, *Poecilia reticulata*. *Canad. Jour. Fish. Aquat. Sci.* 38:23-31. (AC and AD)

Roesijadi, G. 1980. Influence of copper on the clam *Protochaca staminea*: Effects on gills and occurrence of copper-binding proteins. *Biol. Bull.* 158: 223-47. (AA and AB)

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Schimmel, S.C. J.M. Patrick and J. Forester. 1976. Toxicity and bioconcentration of BHC and lindane in selected estuarine animals. Archives of Environmental Contamination and Toxicology, 6 (1): 355-363. (AA, AB, AC, and AD)

Villalobos, S.A., D. Papoulias, J. Meadows, A. L. Blankenship, S. D. Pastva, K. Kannan, D. E. Tillitt and J. P. Giesy. 2000. Toxic Responses of Polychlorinated Naphthalene Mixtures to Medaka (dRr Strain) after Embryonic Exposure by In ovo Microinjection: A Partial Life Cycle Assessment. Environ. Toxicol. Chem. 19:432-440. (AA and AB)

Villalobos, S.A., D.M. Papoulias, S.D. Pastva, A.L. Blankenship, J. Meadows, D.E. Tillitt and J.P. Giesy. 2003. Toxicity of o,p'-DDE to medaka d-rR strain after a one-time embryonic exposure by in ovo nanoinjection: an early through juvenile life cycle assessment. Chemosphere. 53(8): 819-26 (AC and AD)
